Conference Paper

Hand's Asymmetries in Fine Motor Precision and Speed Performance in Different Age Groups

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Abstract

Rose (1970) showed that women had more symmetrical precision in movements in hands, whereas men performed more asymmetrically (with dominance for right hand). These findings were congruent with Ananiev's (1968) scheme differentiated for sexes, in which for men there was a need for use of additional adaptive mechanisms (asymmetry) whereas women passed with basic ones (symmetry). Our study aimed to check the hands symmetry/asymmetry and correlations in fine motor precision and speed in both sexes and how they change in different age groups. The results of our study showed that the highest asymmetry in fine motor precision was related (for both sex groups and among all movement types) to the developmental period of life (12-17 years old) followed by group age of 64-95 due to ageing processes. In our study women performed with less asymmetry between both hands for majority of observable variables compared to men in all age groups. The highest frequency of asymmetrical performance in fine motor precision for both sexes was observed in the Frontal movement type, followed by the Transversal, and least, in the Sagittal. For the speed performance, the highest frequency of asymmetrical performance was shown in the Transversal movement type.

Keywords: fine motor precision; speed; sex differences; age-depended differences; Proprioceptive diagnostics; M.K.P.

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Received: 25 July 2018
Accepted: 9 August 2018
Published: 1 November 2018

Publishing services provided by Knowledge E

Selection and Peer-review under the responsibility of the Fifth International Luria Memorial Congress Conference Committee.

1. Introduction

The famous riddle of the Sphinx: "Which creature in the morning goes on four legs, at mid-day on two, and in the evening upon three, and the more legs it has, the weaker and slowlier it be?" Oedipus solved the riddle by answering:

> *"Man—who crawls on all fours as a baby, then walks on two feet as an adult, and then walks with a cane in old age."*

The famous riddle of the Sphinx reflects the trend of the gross motor activity. Similarly the quadratic shape of age-depended differences also was found in fine motor precision performance [4, 5].

As far as lateralization is concerned, some researchers have shown decreased hand asymmetry in motor tasks with aging [8], while others have reported faster work of the right hemisphere (left hand), which did not change much with age on non-verbal and visual tasks [10]. Research using fMRI has also identified an age-related shift from automatic to more cognitively controlled movements as subjects get older [2].

Rose (1970), with use of the Miokinetical Psychodiagnosis method [7], showed that women had more symmetrical precision in movements in hands, whereas men performed more asymmetrically (with dominance for right hand). These findings were congruent with Ananiev's (1968) scheme differentiated for sexes, in which for men there was a need for use of additional adaptive mechanisms (asymmetry) whereas women passed with basic ones (symmetry).

Our study aimed to check the hands symmetry/asymmetry in fine motor precision and speed in both sexes in different age groups. Moreover, the psychological meanings of such differences is given also based on interpretations of M.K.P. [7] and Proprioceptive Diagnostics of Temperament and Character (DP-TC; [11]) methods.

2. Methodology

The Proprioceptive Diagnostics of Temperament and Character (DP-TC, [11]), a digitalized version of the subtests Lineograms of M.K.P. [7], was applied in 200 participants (mean age of 33 years, range: 12-95). We observed their fine motor performance and speed in three movement types (Frontal, Transversal and Sagittal) and two sensory conditions (PV- proprioceptive-visual and P – proprioceptive only) represented in four age groups: 12-17; 18-29; 30-64, and 65-95. More details on the tools, instructions can be found in the published previously articles in English [11, 12].

Two types of observable variables were used in this study:

1. *for precision*: LL – line length; D – directional bias; F – Formal bias) [11, 12],
2. *for speed*: Time spent on the performance of each task.

The study design: two hands (dominant and non-dominant) x two sensory conditions (PV – proprioception with vision and P – proprioceptive only) x three movement types (Frontal, Transversal and Sagittal).

The statistical analysis was performed with use of the SPSS v.20.

All participants took part voluntarily, were informed about the aims of the research and gave their consent prior to inclusion in the study. The study was performed according to ethical committee recommendations and in accordance with the Declaration of Helsinki on human research.

3. Results and Discussion

The descriptive statistics is described with details in the PhD thesis work [5]. The results below show the paired correlations (Table 1) and *t*-differences (Table 2) between both hands performances for the observed variables in different test conditions.

3.1. The relationship between both hand performances in men and women in different age groups

The highest frequency of correlations in performance was observed for speed (Time spent on task performance). In men for all movement types and age subgroups (100%); whereas in women it was the same (100%) in Frontal and Sagittal movements; but in Transversal movement type no statistically significant correlations were performed between both hands at age 30-64 (P and PV sensory conditions) and 12-17 (only P condition).

As per precision biases, depending on movement type and sensory conditions in a sum per all age subgroups we have the picture quite similar for both sexes: in five cases women had fewer correlations compared to men; in four cases *vice versa*, and in nine cases these indicators were equal between groups of different sexes. If analyse per each age group separately, women had fewer correlations at ages 12-17 (38%) compared to men (46%) and 30-64 age group (46% vs. 58%). Whereas in the age group of 18-29 participants of both sexes performed equally (50% vs 50%), and at the elder group women had slightly more statistically significant correlations met in fine precision performance (58% vs. 54%).

Table 1: Paired correlations between both hands.

		Age group	12-17		18-29		30-64		65-95		% F/M
MT	TC	Bias/Sex	F	M	F	M	F	M	F	M	
Frontal	P	LL	.50	**.56****	**.81*****	**.74*****	**.89****	**.63*****	**.89*****	**.87*****	75/100%
		D	**.58***	**.48****	**.73****	.18	.36	**.47*****	**.63***	.01	75/50%
		F	.35	-.07	-.14	**.34***	.31	.09	**.62***	.15	25/25%
		Time	**.96*****	**.90*****	**.91*****	**.96*****	**.99*****	**.99*****	**.93*****	**.96*****	100/100%
	PV	LL	.38	.32	.46	.19	**.77***	**.29***	.37	**.68***	25/50%
		D	.14	**.39***	-.01	.13	.39	**.26***	.09	.12	0/50%
		F	-.45	.23	-.14	.00	.16	-.19	-.12	.02	0/0%
		Time	**.97*****	**.94*****	**.92*****	**.89*****	**.99****	**.96***	**.88*****	**.94*****	100/100%
Trans-versal	P	LL	.08	**.55****	**.68****	**.45*****	**.90****	**.51*****	**.66****	**.78****	75/100%
		D	.03	-.03	-.42	.13	**-.77***	.00	-.04	**.60***	25/25%
		F	.17	**.48****	.34	**.29***	.32	.04	**.67****	.16	25/50%
		Time	.35	**.89*****	**.93*****	**.88*****	.68	**.90***	**.89*****	**.64****	50/100%
	PV	LL	-.09	.33	**.67****	**.49*****	**.96*****	**.28***	.08	.24	50/50%
		D	-.06	.18	.33	.15	.66	-.20	.11	-.20	0/0%
		F	-.12	.15	-.28	.28	.15	.04	**.73****	.36	25/0%
		Time	**.92*****	**.88*****	**.88*****	**.81*****	.58	**.84****	**.90*****	**.82****	75/100%
Sagittal	P	LL	.46	-.03	**.80*****	**.62*****	**.94*****	**.57*****	**.78*****	**.88*****	75/75%
		D	**.58***	.22	**.64***	.26	.21	.19	**.65***	**.84*****	75/25%
		F	-.47	.04	.02	-.20	-.22	.21	.37	-.45	0/0%
		Time	**.98*****	**.95*****	**.93*****	**.47****	**.93*****	**.96***	**.95*****	**.80****	100/100%
	PV	LL	**.69***	.24	.13	.02	**.73***	**.28***	.00	**.61***	50/50%
		D	-.02	-.02	.37	-.28	-.24	.25	-.01	.29	0/0%
		F	**.73****	.04	-.13	.16	.11	.08	-.51	.39	25/0%
		Time	**.95*****	**.96*****	**.92*****	**.90*****	**.93*****	**.97***	**.95*****	**.77****	100/100%
% of significant cases of total			**38%**	**46%**	**50%**	**50%**	**46%**	**58%**	**58%**	**54%**	

Legend: Test sensory conditions: PV – proprioceptive-visual; P – proprioceptive only; **in bold** are significant correlations ((significance level: * $p<.05$, ** $p<.01$, *** $p<.001$).

3.2. The asymmetry in fine motor performance in men and women in different age groups

As per results represented in Table 2, the highest percentage of asymmetrical performance (as per quantity of statistically significant differences observed) in fine motor precision and speed, the most non-harmonised age is 12-17 for both sexes. The age

Table 2: Paired differences between both hands.

		Age group	12-17		18-29		30-64		65-95		% F/M
MT	TC	Bias/Sex	F	M	F	M	F	M	F	M	
Frontal	P	LL	-0.45	-0.20	0.59	1.04	0.08	0.08	-0.53	0.83	0/0%
		D	0.04	**2.48***	0.30	**3.08***	1.84	**4.60*****	1.81	1.06	0/75/%
		F	-0.67	-0.98	-0.46	0.14	1.28	-2.21	-1.75	0.42	0/0%
		Time	**-2.29***	-1.21	0.78	0.44	2.35	**-2.01***	-1.14	-1.69	25/25%
	PV	LL	**2.37***	1.70	1.08	**3.44*****	1.80	**-2.48***	0.36	**3.22****	25/75%
		D	-0.64	-0.16	-0.89	**-2.61***	-0.95	1.70	0.05	-0.50	0/25%
		F	-0.25	**2.47***	-1.10	1.43	-1.60	-0.78	1.88	1.54	0/25%
		Time	-.60	1.28	.078	0.19	1.76	1.61	-1.32	**-2.41***	0/25%
Trans-versal	P	LL	1.28	**2.46***	1.04	0.66	0.97	-1.22	-1.17	0.95	0/25%
		D	1.16	1.23	-1.21	-0.31	-0.11	-1.50	**2.77***	-0.74	25/0%
		F	0.47	**-2.82****	0.23	-1.39	-0.19	-0.74	-1.88	-1.12	0/25%
		Time	0.63	-0.92	-0.05	0.42	1.10	**2.61***	**-2.41***	**-2.76***	25/50%
	PV	LL	1.34	**2.71***	1.25	0.01	-0.12	-1.41	1.93	1.23	0/25%
		D	-0.46	0.07	0.00	-1.22	-0.59	-1.94	-1.11	-0.96	0/0%
		F	**-2.24***	-1.73	-1.21	-1.27	-1.22	-1.80	-1.50	-0.28	25/0%
		Time	**-3.96****	**-3.90*****	**-3.67****	**-2.73****	-0.17	0.92	**-2.30***	**-2.76***	75/75%
Sagittal	P	LL	**2.20***	-0.03	0.08	0.91	0.24	0.13	0.15	-0.20	25/0%
		D	-0.81	-1.44	-0.65	-0.19	-0.37	0.88	-0.62	0.96	0/0%
		F	0.92	0.91	-0.43	-1.31	-0.62	-0.24	0.41	-0.72	0/0%
		Time	-1.51	-0.72	0.15	063	0.13	0.03	-1.81	0.02	0/0%
	PV	LL	-0.56	1.00	0.00	-0.54	-1.58	0.03	-0.61	-0.02	0/0%
		D	-0.91	-1.33	-1.27	-0.20	0.68	0.33	0.54	0.61	0/0%
		F	0.27	0.91	0.58	-0.45	-1.76	-1.70	-0.16	-0.88	0/0%
		Time	-0.93	**-2.06***	0.02	-0.71	0.21	0.38	-2.00	-0.41	0/25%
% of significant cases of total			**21%**	**29%**	**4%**	**17%**	**0%**	**13%**	**13%**	**17%**	

Legend: P – proprioceptive condition; PV – proprioceptive + visual condition; **in bold** are significant differences (significance level: * $p<.05$, ** $p<.01$, *** $p<.001$).

were the asymmetry was lowest was shown 30-64. This dynamics is related to maturation processes and further decline after the middle point to aging processes [4].

In all age groups the asymmetry in women was less frequent compared to men that confirms the previous general studies that described only line length performance (LL) [9] and theoretical work in this area [1]. However, the results of this study showed for the first time the dynamics of asymmetry/symmetry in the performance per different age groups. Moreover, they are represented in three bias types (LL – line length, D – directional and F – formal) and speed (Time spent on task performance), three

movement types (Frontal, Transversal and Sagittal) and two sensory conditions (PV – proprioceptive with vision and P – proprioceptive only).

In general, our study results suggest the existing more complex relationship of correlations and symmetry/asymmetry in fine motor precision performance and speed performance in both sexes. It depends on age, movement type and sensory condition of the test.

The psychological meaning of statistically significant differences suggest of passing via more "unbalanced" or "critical" periods of human development in general. To see more specific features, as described in

4. Conclusions

The highest asymmetry for both sexes was observed in age group 12-17. Women have not shown any asymmetry in the middle group ages (18-29 and 30-64). As for speed performance, the highest frequency in difference (asymmetry) was found for both sexes in Transversal movement, in all ages. For fine motor precision, the asymmetrical performance between both hands was observed in the Frontal movement type, and least, in Sagittal one.

To sum up, the results of our study confirm more symmetry (less asymmetry) between both hands performance in fine motor precision tasks in women compared to and men in all four age groups. The dynamical changes show that the percentage of the asymmetry is decreasing from the younger age group (12-17 years old) to the middle one (30-64) and then increasing again in the older group (65-95) for both sex subgroups.

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